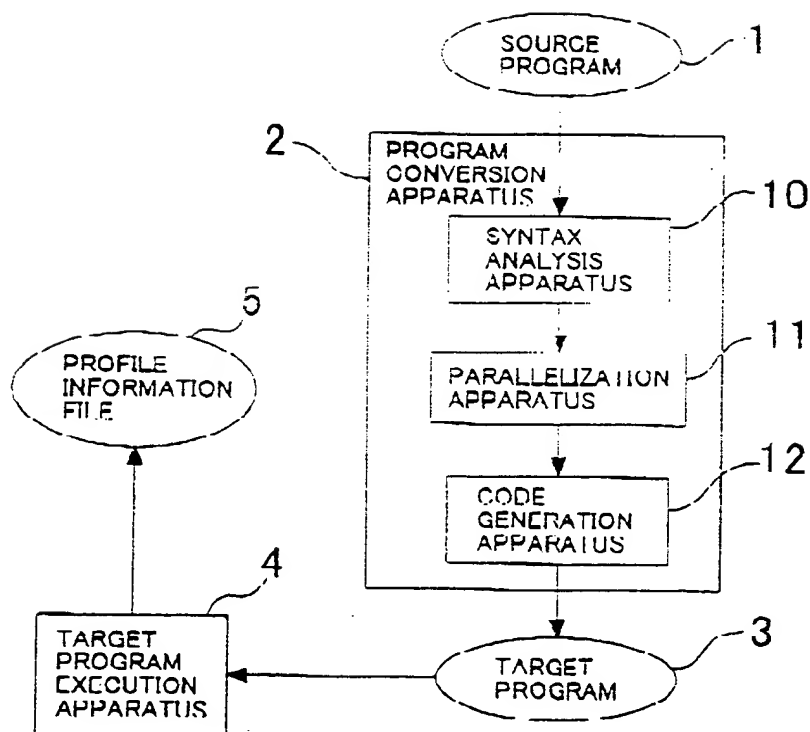


FIG. 1



Best Available Copy

FIG. 2

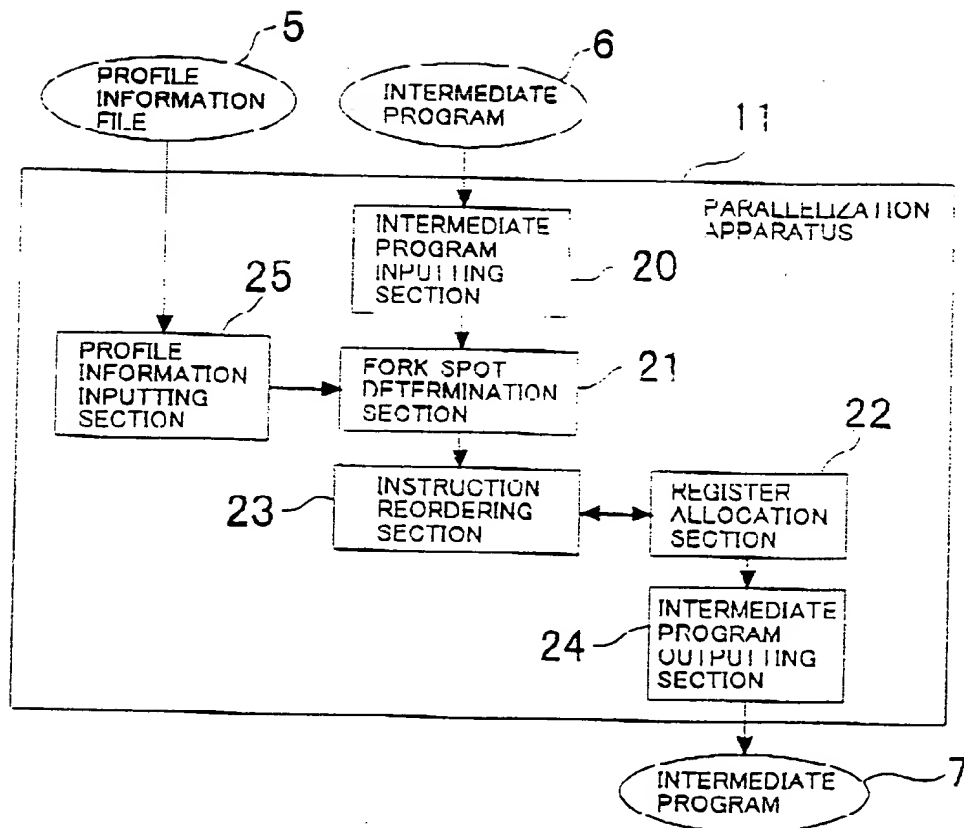


FIG. 2

FIG. 3

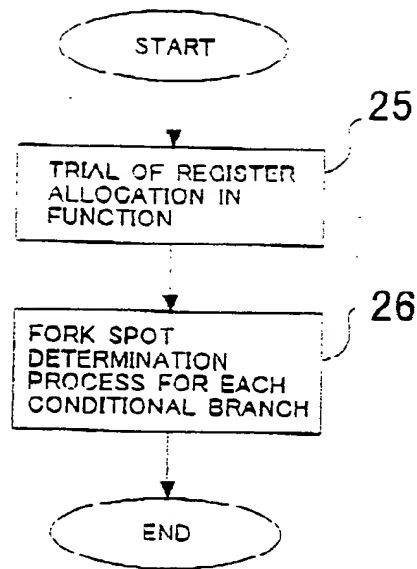


FIG. 4

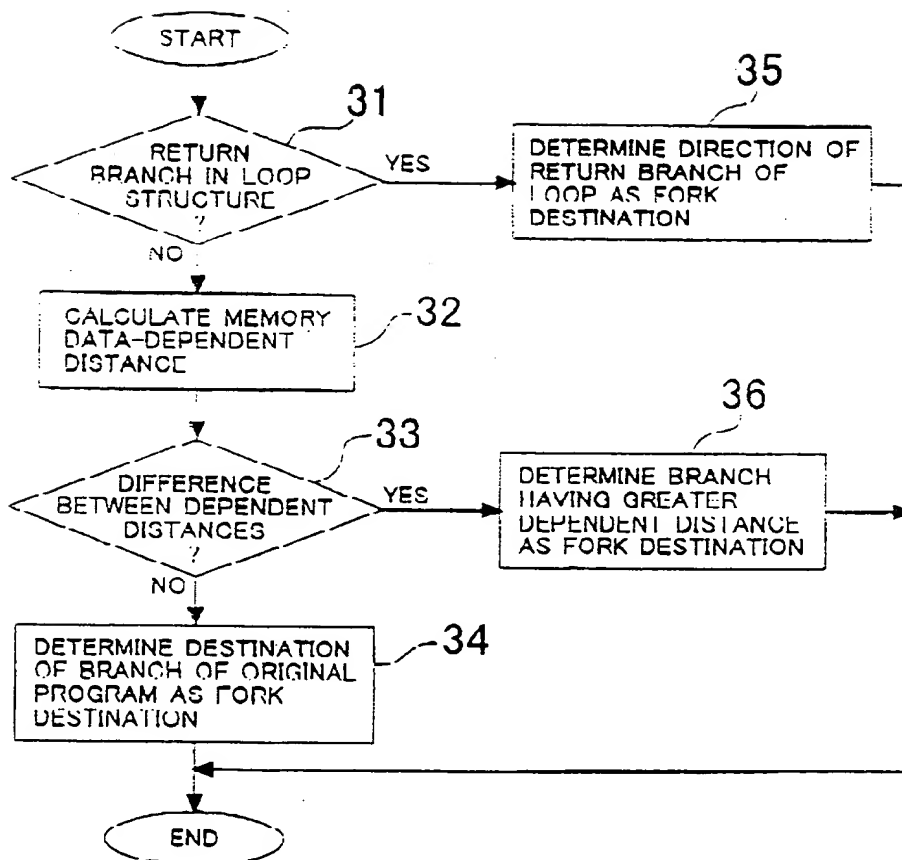
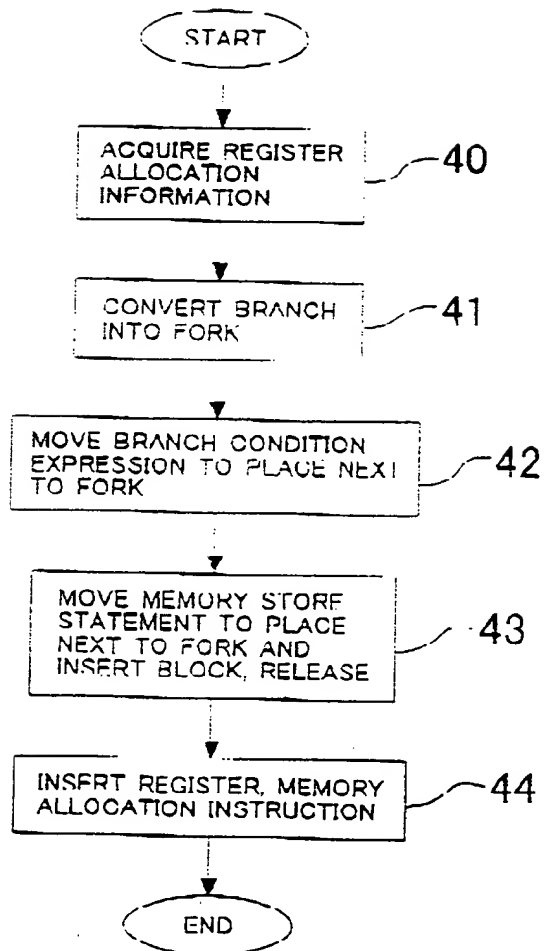


FIG. 4

FIG. 5



10020-1111360

FIG. 6(A)

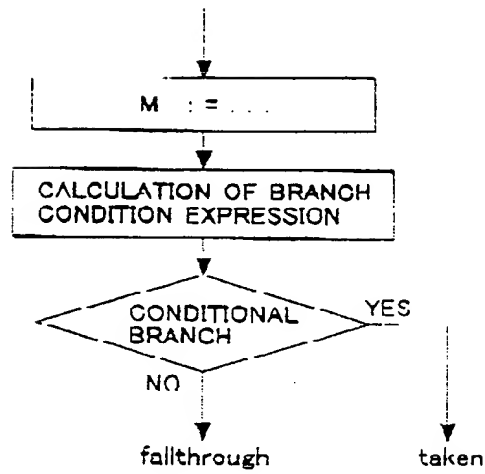


FIG. 6(B)

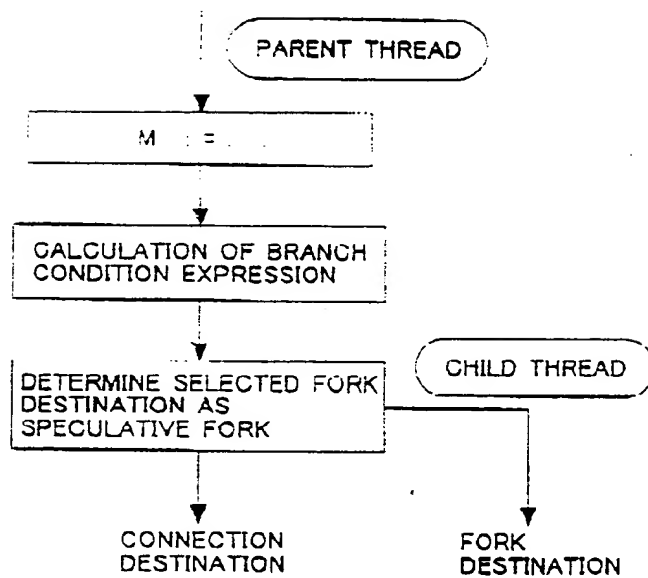


FIG. 6(B)

FIG. 6(D)

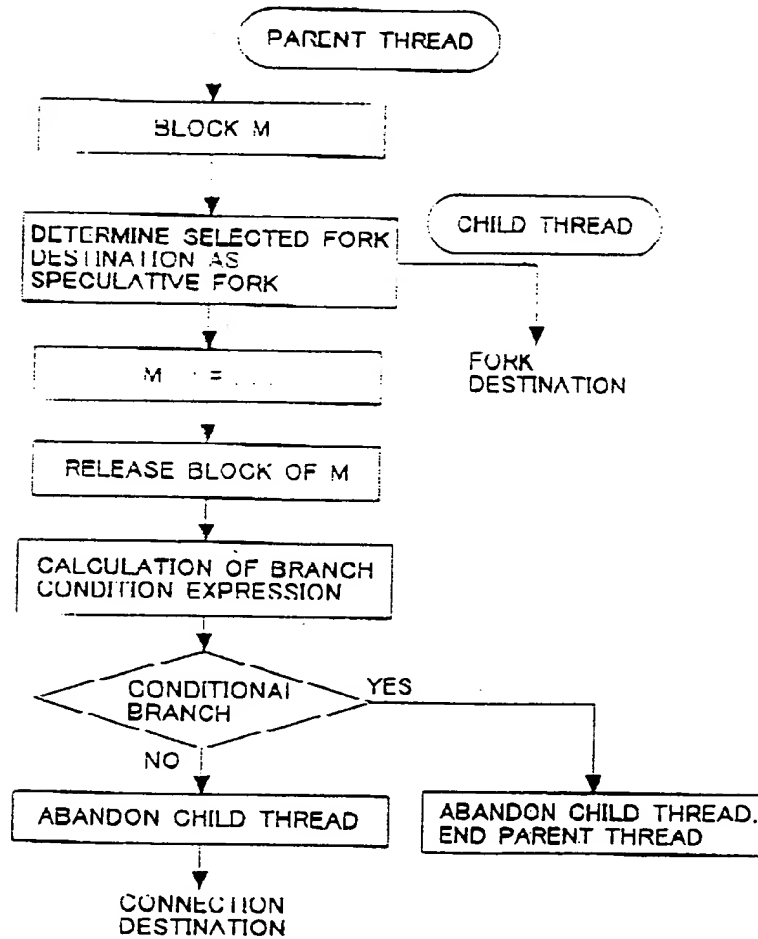


FIG. 6(E)

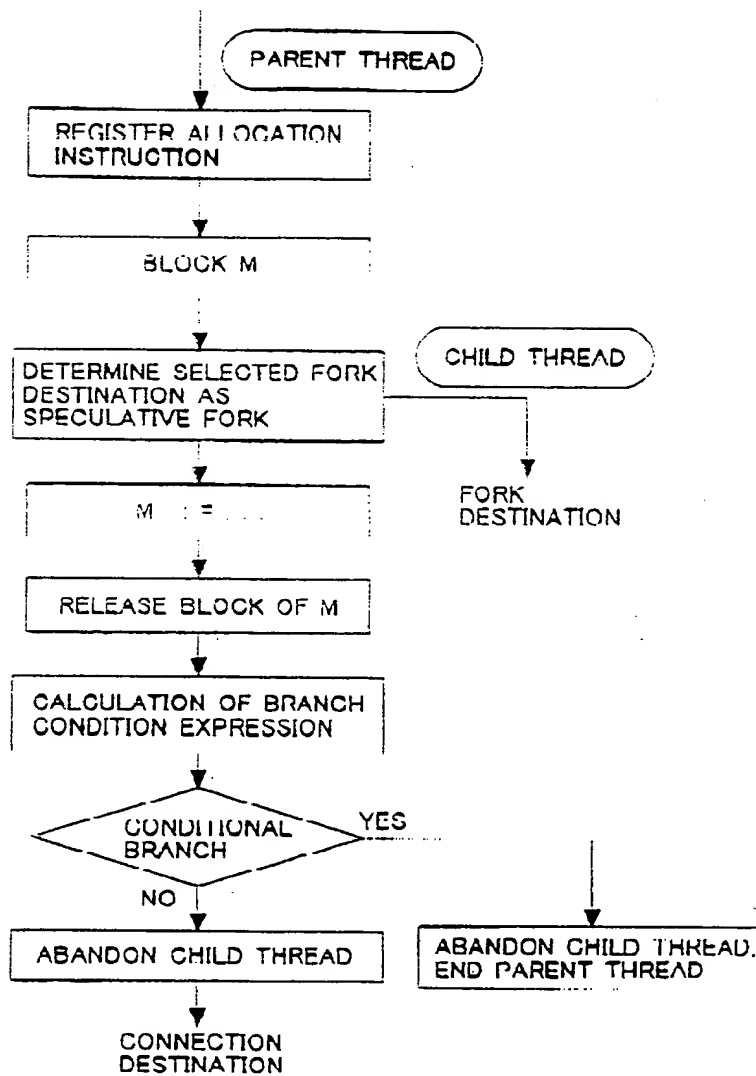


FIG. 6(E)

FIG. 7

SPFORK 1	TO CREATE A SPECULATION MODE CHILD THREAD FOR STARTING EXECUTION FROM 1
TTERM c	TO END SELF THREAD AND SETTLE CHILD THREAD IF c IS TRUE
FTERM c	TO END SELF THREAD AND SETTLE CHILD THREAD IF c IS FALSE
THABORT	TO ABANDON A CHILD THREAD OF A SPECULATION MODE
BLACK m	TO DESIGNATE A MEMORY ADDRESS DESIGNATED WITH M AS BLOCK
RELEASE m	TO CLEAR BLOCK SET TO MEMORY ADDRESS DESIGNATED WITH M
DSPIN	TO CREATE A CHILD THREAD CREATED BY SUCCEEDING FORK IN DATA-DEPENDENT SPECULATION MODE
DSPOUT	TO CLEAR DATA-DEPENDENT SPECULATION MODE OF CHILD THREAD
RDCL t, ...,	TO INSTRUCT TO ALLOCATE INTERMEDIATE TERMS/ VARIABLES DESIGNATED WITH t, ... TO REGISTER
MDCL t, ...,	TO INSTRUCT TO ALLOCATE INTERMEDIATE TERMS/ VARIABLES DESIGNATED WITH t, ... TO MEMORY

FIG. 7

FIG. 8

```
( 1)  t1 := &X
( 2)  t2 := 1
( 3)  t3 := 4
( 4)  t4 := t2 * t3
( 5)  t5 := t1 + t4
( 6)  t6 := 1
( 7)  mem(t5) := t6
( 8)  t7 := 1
( 9)  t8 := 20
(10)  t9 := t7 > t8
(11)  if false then goto L2
(12)  L1:
(13)  t10 := &X
(14)  t11 := J
(15)  t12 := 4
(16)  t13 := t11 * t12
(17)  t14 := t10 + t13
(18)  t15 := mem(t14)
(19)  t16 := J
(20)  t17 := t15 + t16
(21)  R := t17
(22)  goto L3
(23)  L2:
(24)  t18 := K
(25)  t19 := 10
(26)  t20 := t10 / t19
(27)  R := t20
(28)  t21 := &X
(29)  t22 := J
(30)  t23 := 4
(31)  t24 := t22 * t23
(32)  t25 := t21 + t24
(33)  t26 := mem(t25)
(34)  t27 := R
(35)  t28 := t26 + t27
(36)  R := t28
(37)  L3:
```

(B1)

(B2)

(B3)

FIG. 9

```

(51)  t1 := &X
(52)  t2 := I
(53)  t3 := 4
(54)  t4 := t2 + t3
(55)  t5 := t1 + t4
(56)  t6 := 1
(57)  mem(t5) := t6
(58)  SPFORK L2
(59)  t7 := I
(60)  t8 := 20
(61)  t9 := t7 > t8
(62)  FTERM
(63)  IHABORT
(64)  goto L1
(65)  L1:
(66)  t10 := &X
(67)  t11 := J
(68)  t12 := 4
(69)  t13 := t11 * t12
(70)  t14 := t10 + t13
(71)  t15 := mem(t14)
(72)  t16 := J
(73)  t17 := t15 + t16
(74)  R := t17
(75)  goto L3
(76)  L2:
(77)  t18 := K
(78)  t19 := 10
(79)  t20 := t18 / t19
(80)  R := t20
(81)  t21 := &X
(82)  t22 := J
(83)  t23 := 4
(84)  t24 := t22 * t23
(85)  t25 := t21 + t24
(86)  t26 := mem(t25)
(87)  t27 := R
(88)  t28 := t26 + t27
(89)  R := t28
(90)  L3:

```

(B1)

(B2)

(B3)

FIG. 10

```

(101)  t1 := &X
(102)  t2 := 1
(103)  t3 := 4
(104)  t4 := t2 * t3
(105)  t5 := t1 + t4
(106)  BLOCK t5
(107)  SPFORK L2
(108)  t6 := 1
(109)  mem(t5) := t6
(110)  RELEASE t5
(111)  t7 := 1
(112)  t8 := 20
(113)  t9 := t7 > t8
(114)  FTERM
(115)  THABORT
(116)  goto L1
(117)  L1:
(118)  t10 := &X
(119)  t11 := J
(120)  t12 := 4
(121)  t13 := t11 * t12
(122)  t14 := t10 + t13
(123)  t15 := mem(t14)
(124)  t16 := J
(125)  t17 := t15 + t16
(126)  R := t17
(127)  goto L3
(128)  L2:
(129)  t18 := K
(130)  t19 := 10
(131)  t20 := t18 / t19
(132)  R := t20
(133)  t21 := &X
(134)  t22 := J
(135)  t23 := 4
(136)  t24 := t22 * t23
(137)  t25 := t21 + t24
(138)  t26 := mem(t25)
(139)  t27 := R
(140)  t28 := t26 + t27
(141)  R := t28
(142)  L3:

```

(B1)

(B2)

(B3)

FIG. 12

```
(255) r21 := &X
(256) r22 := r11
(257) r23 := 4
(258) r24 := r22 * r23
(259) r25 := r21 + r24
(260) BLOCK r25
(261) SPFORK L2
(262) r26 := 1
(263) mem(r25) := r26
(264) RELEASE r25
(265) r27 := r11
(266) r28 := 20
(267) r29 := r27 > r28
(268) FTERM r29
(269) THABORT
(270) goto L1
(271) L1:
(272) r20 := &X
(273) r21 := mem(&J)
(274) r22 := 4
(275) r23 := r21 + r22
(276) r24 := r20 + r23
(277) r25 := mem(r24)
(278) r26 := mem(&J)
(279) r27 := r25 + r26
(280) r12 := r27
(281) goto L3
(282) L2:
(283) r20 := r13
(284) r21 := 10
(285) r22 := r20 / r21
(286) r12 := r22
(287) r23 := &X
(288) r24 := mem(&J)
(289) r25 := 1
(290) r26 := r24 * r25
(291) r27 := r23 + r26
(292) r28 := mem(r27)
(293) r29 := r12
(294) r30 := r28 + r29
(295) r12 := r30
(296) L3:
```


FIG. 13

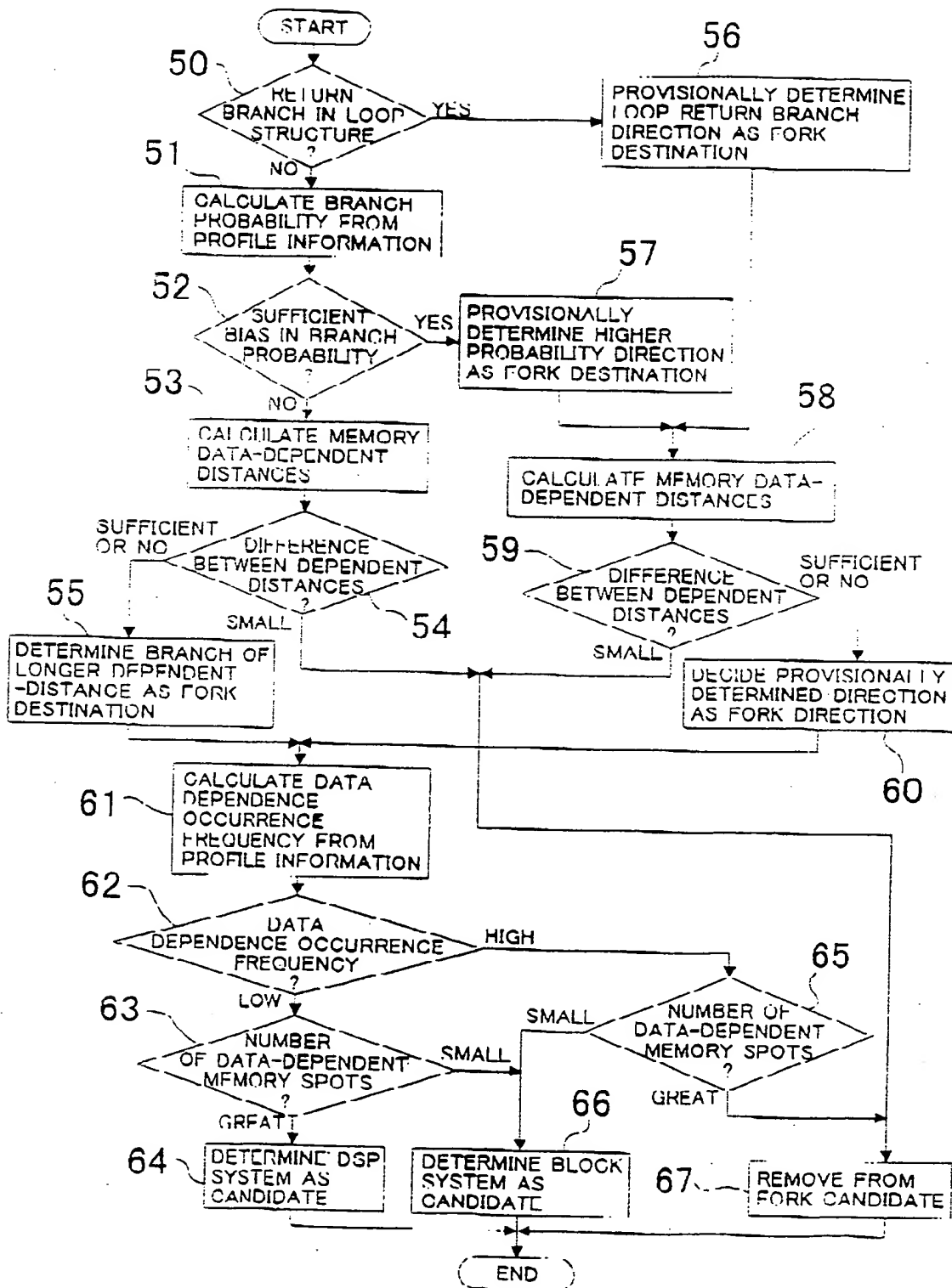
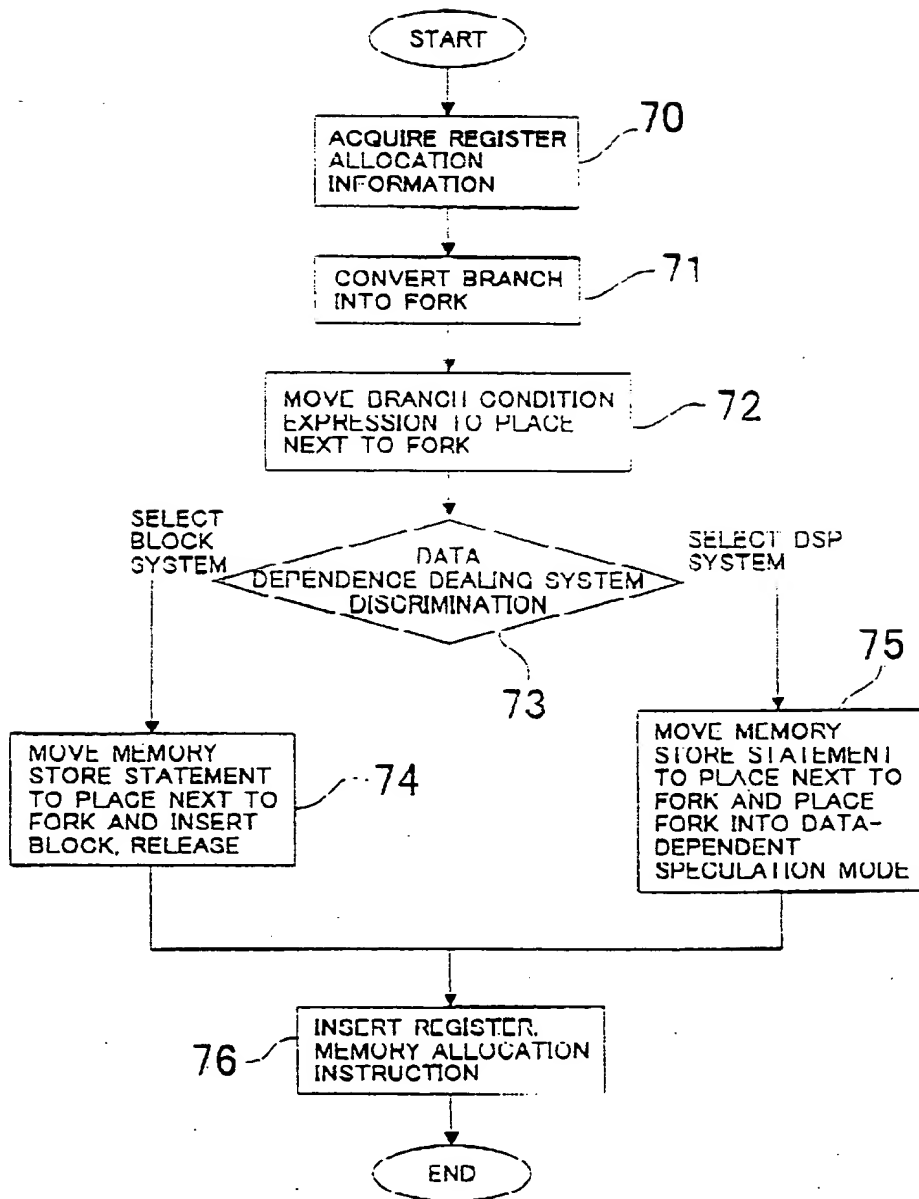


FIG. 14



```
t12 := 2
mem(t12) := t11
t13 := &X
t14 := 0
t15 := 4
t16 := t14 * t15
t17 := t13 + t16
t18 := mem(t17)
t19 := J
t20 := t18 + t19
mem(t17) := t20
K := t20
t21 := &X
t22 := P
t23 := 4
t24 := t22 * t23
t25 := t21 + t24
t26 := mem(t25)
t27 := 8
t28 := t26 + t27
```

```

L5:      t29 := &X
        t30 := P
        t31 := 4
        t32 := t30 * t31
        t33 := t29 + t32
        t34 := mem(t33)
        t35 := 1
        t38 := t34 - t35
        mem(t33) := t36

L6:      t37 := &Y
        t38 := P
        t39 := 4
        t40 := t38 * t39
        t41 := t37 + t40
        t42 := mem(t41)
        t43 := K
        t44 := t42 + t43
        J := t44

```

FIG. 16(A)

BRANCHING NUMBER

R 11	R 12: 2D	R 13: 18D
R 13	R 14: 3D	R 15: 17D
B 15	B 16: 3D	B 17: 17D

FIG. 16(B)

MEMORY DATA DEPENDENCE

B 15 → B 16	12D
B 15 → R 17	4

FIG. 17

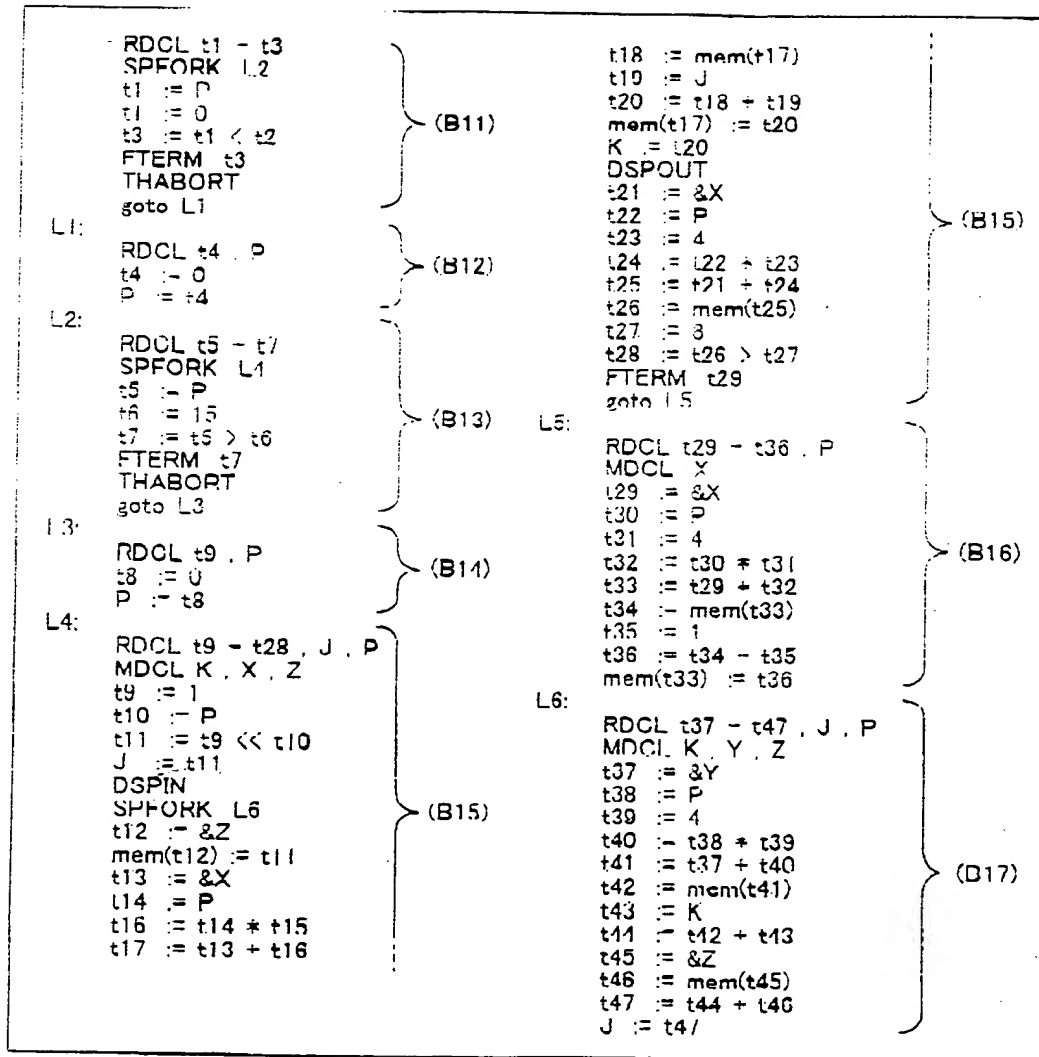


FIG. 18

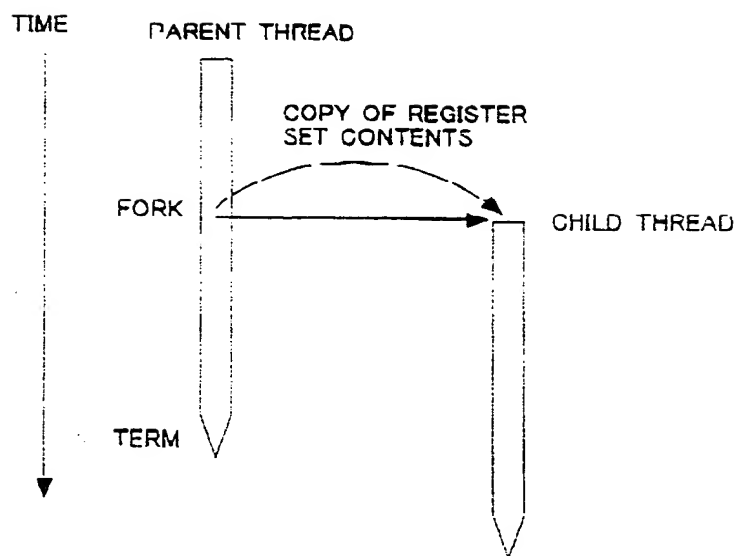


FIG. 19

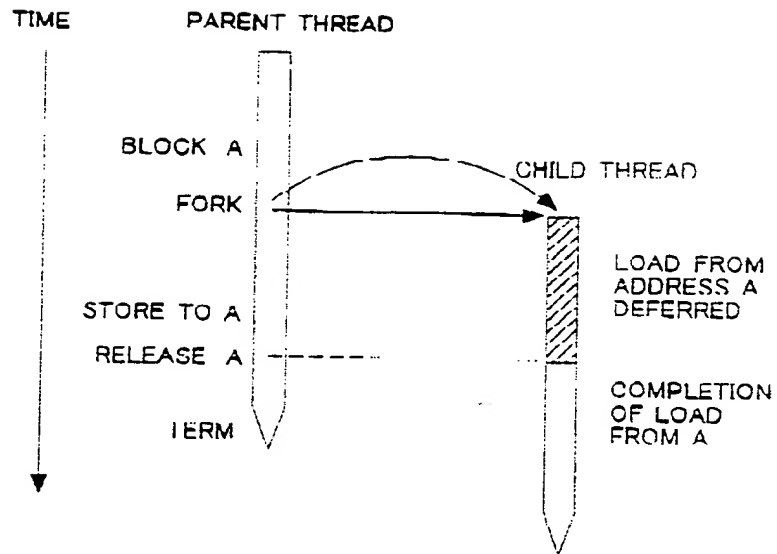


FIG. 19

FIG. 20(A)

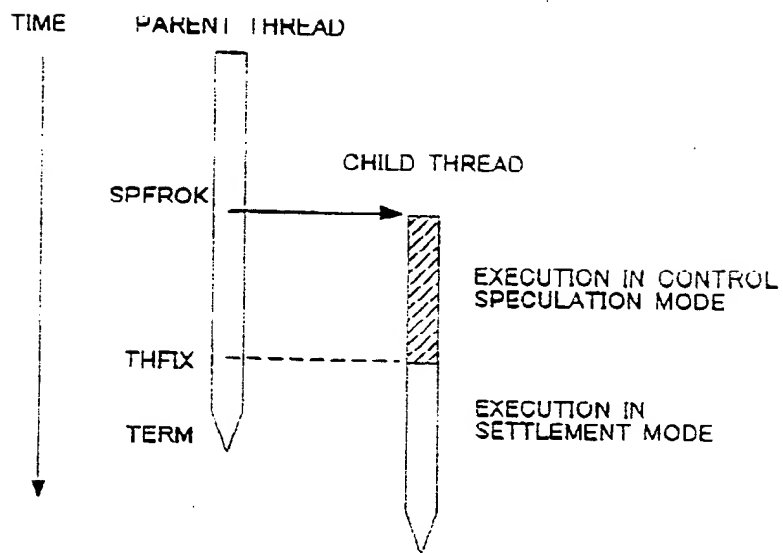


FIG. 20(B)

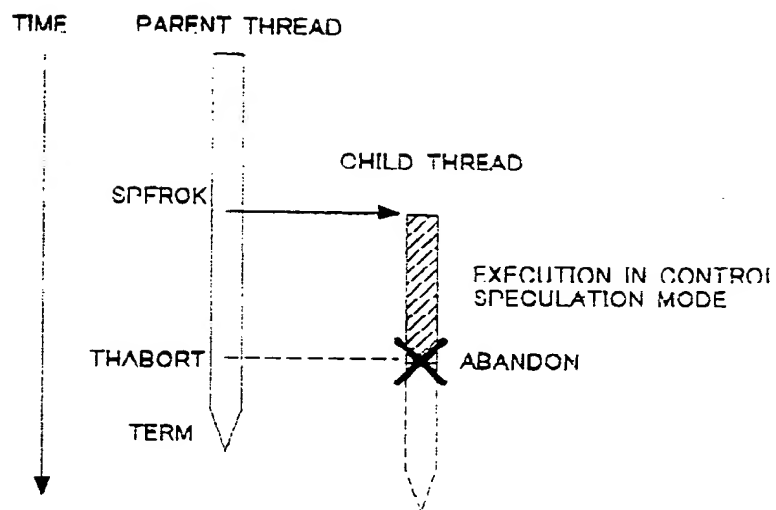
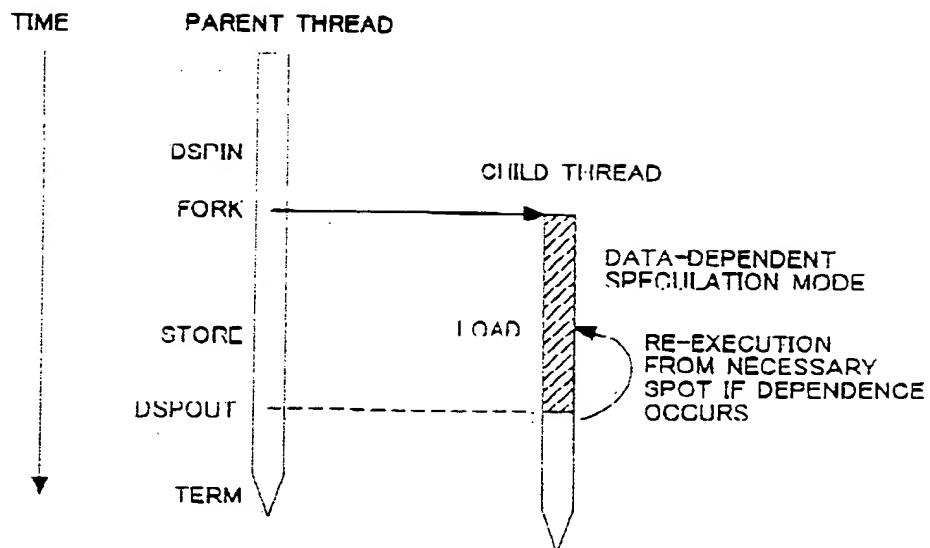


FIG. 21



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